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ABSTRACT

The American school system is an invention of the Industrial Revolution. Schools were organized like industries to train workers for an industrial society. The resulting large, low-context, industrial schools institutionally discriminate against Native students. Also antagonistic to Native students is the dogma of Western science, a reductionist model that accepts only observable, quantifiable, replicable information as valid. However, the technology of industrial education has reached its upper limit of performance and is proving inadequate to meet the expectations of society. On the horizon is a new educational paradigm, a new way of viewing reality, supported by new technological tools. These tools include local area computer networks, integrated learning systems, CD-ROM technology, computer managed instruction, computer assisted instruction, multimedia systems, statewide and other large scale computer information systems and databases, and distance education technologies. Ten distance education delivery systems are outlined, and 11 Native American distance education programs or networks are described. Teacher and administrator training in technology techniques are discussed. Reasons for which Native groups are turning to technology-assisted solutions to educational problems include: gaining skills to compete in mainstream culture; maintaining traditional knowledge or blending it with contemporary understanding of the world; strengthening Native cultural identity; organizing as a Native community across tribal lines and geographic distance; sharing Native culture as an educational or artistic product; and teaching non-Natives about Native culture. This paper contains over 150 references. (SV)

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Strategic Plans for Use of Modern Technology in the Education of American Indian and Alaska Native Students

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Paul K. Berg and Jason Ohler

Introduction

Numerous reports from governmental and private agencies have documented the failure of public education to meet the needs of Native students. As educational technologists, we set out to find an explanation for this phenomenon and to identify successful educational strategies.

Using technology, we traveled thousands of miles, stopped many places and met many people without leaving our homes. Through phone, computer, and mail, we gathered information from people about their experiences with technology in Native education. We used computer networks to post requests for information. We searched databases thousands of miles away and learned from the insights of many practitioners and researchers. We contacted hundreds of people for help. The ability of technology to amplify our requests for information helped us to see patterns and to identify potential solutions. This paper presents strategies using educational technology to benefit American Indians and Alaska Natives.

America's Industrial School System

Industrial technology has been a major influence in American education. The education system is a creation of an industrial society. The public school system developed and grew to maturity during a period of rapid industrial expansion. The education system adopted the principles and metaphors of factory production. For example, the theme of productivity recently came to the educational forefront. A report published by the National School Boards Association tells educators that productivity must become the main concern of the next wave of school improvement (as cited by Komoski, 1987, p. 3).

The technology of the industrial revolution provides the tools for teaching. In the early years of the nineteenth century, textbooks were expensive, shared resources. The ideal of one textbook per child for each major subject was made possible by the development of steam-powered printing presses and the mass production of textbooks. The textbook evolved from a valuable, shared reference to a personal instructional tool. Mass produced textbooks, workbooks, and worksheets now dominate the classroom. The Educational Products Information Exchange Institute (EPIE) estimates that 90-95 percent of in-school learning involves the use of printed instructional materials (Komoski, p. 4).

Industry provided the organizational model for the growing public school system. Millions of immigrants arrived in North America during the latter part of the nineteenth century. The managers of the public education system looked to industrial models of organization for methods of processing large numbers of new students through the system. Young people attended schools to learn industrial roles in a lock step, cohort method of group processing (Hathaway, Summer, 1989, p. 25). Secondary schools became larger and larger as education managers strived to achieve the industrial management goal of economy of scale. Many of the larger secondary schools began to look remarkably like factories from the outside. The resemblance is more than coincidental.

The organizational technology of the industrial era focused on vertical management structures, economy of scale, and the assembly-line method of production. The vertical teacher-principal-superintendent-school board organizational structure parallels the worker-foreman-president-board of directors pattern of corporate organizations.

Industrial methods of measurement have influenced the way schools assess educational achievement. School systems evaluate education with standardized, machine graded tests. The multiple choice question format dominates the tests, not because it is a superior format for evaluating a student's responses, but because it is acceptable to industrial era grading machines. The public evaluates educational achievement with a numerical grade equivalent score similar to a production output figure. This phenomenon of the industrial mind ... the desire to reduce a complex phenomenon to a numerical score ... reached its

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zenith of absurdity with the weekly body count issued by the Pentagon during the Vietnam War.

The industrial structure of school systems brought about a corresponding development in employee behavior. Union negotiations, strikes, and picket lines are common occurrences in American education. Industrial labor relations are the status quo in school systems.

Schools have also internalized the industrial principle of mass production of standardized parts. As a factory produces standardized products, public schools strive to produce children with standardized minds for an industrial society. Without apology or afterthought, industrial schools measure the quality of their product with standardized achievement tests.

Industrial Secondary Schools — A Low Context Environment

Schools are low context, cultural environments according to anthropologist Edward T. Hall. In low context educational environments, students have access to minimum amount of background information. "That is, there is a need to tell everybody everything in great detail (this applies particularly to instructions)" (Hall, 1989, Fall, p. 25). Students in a low context education system need a continuous flow of directions and information from the teacher.

Large secondary schools are low context educational environments. In many classes, few of the students know each other. The context changes hourly. Imagine a work situation where workers change desks, rooms, bosses, co-workers, and expectations each hour. This creates an impossible work situation for the students. In low context secondary schools, the teachers are the workers and the students are passive receivers of information (Boyer, 1983, p. 147). The Carnegie Report on American High Schools states that American high school students are characterized by passiveness and low engagement in the learning process (Boyer, p. 147).

In contrast, students extract meaning from the environment in a high context educational setting. Verbal communication serves more as a releaser for what is already known. The person in a high context setting inhabits a "sea of information" (Hall, 1989, Fall, p. 27) and there is little need to transmit detailed directions about expectations and procedures.

Native people have high context cultural traditions. They strive for harmony, do not generally promote their needs over others, value moderation in speech, and value being a good listener (*American Indian/Alaska Native Education: Quality in the Classroom, Human and Civil Rights National Association*, 1983, p. 11). High context people, according to Hall, experience discomfort and feel put down in low context environments (Hall, p. 26). Gregory Cajete, an educator from Santa Clara Pueblo, described the effect of low context education on Native children. "When the Indian children had to leave the 'home room' where they were all together with one teacher and take separate subjects with different teachers, the trouble began. All those different teachers held different views. They arranged their subjects differently. That's when the world started to come apart" (as cited by Hall, p. 27).

We submit that large, low context, industrial schools institutionally discriminate against Native students.

The Scientific Myth

A system of beliefs about the nature of reality underlies the industrial education system. Vine Deloria refers to this underlying principle as reductionism — the tendency to perceive reality as being naturally divided into discreet categories. This view of the world, according to Deloria, is enhanced by the success of modern technology in the physical world (Deloria, 1990, Winter, p. 12).

Science has produced a system of thought to explain the questions of existence (Burke, 1985, p. 334). Science has replaced myth in the modern mind. According to James Burke, "Myths confer stability and certainty because they explain why things happen or fail to happen, as does science" (Burke, p. 336). He further writes, "Science, therefore ... is not what it appears to be. It is not objective and impartial since every observation it makes of nature is impregnated with theory. Nature is so complex and random that it can only be approached with a systematic tool that presupposes certain facts about it" (Burke, p. 336).

Scientific reductionism has become the modern western myth. The prevailing dogma of the myth is that information is valid only if it is observable, quantifiable, and replicable. This belief is institutionalized in the disciplines of western science and technology to the degree that the western mind has identified scientific "truth" with reality. However, science is not reality. Science is a way of perceiving and structuring the observable world.

The limitations of the scientific method are apparent when we examine phenomena which are inexplicable in terms of science. Plausible examples abound. Acupuncture was dismissed by western science as superstition until the early 1970s. The auras photographed through specialized photographic techniques defy scientific ex-

planation. The Gaia hypothesis suggests that earth's steady states may not be lucky coincidence, but part of a larger scheme of life.

A notable feature of scientific reductionism is that it is an absolute myth. Many cultural myths are accepted by their followers as methods of metaphorically organizing and explaining reality. They recognize the limitations of their way of organizing knowledge and give credence to other ways of perceiving reality. In comparison to many other world views, western science is rigid and absolute.

Scientific reductionism is intolerant of other sources of knowledge. Information that is not processed through the quantitative procedures of scientific rigor has no validity from the scientific perspective. The education system supports this absolute view, especially at the university level. Professional training reinforces the undisputed supremacy of western science. Educators trained from the scientific point of view share an absolute perspective. The unconscious baggage of many teachers of Native students is an unquestioned attitude of cultural superiority supported by the absolutism of the scientific myth.

Impact of the Industrial School on Native Students

An overwhelming body of evidence suggests that the experience of the Native students with America's industrial education system has not been successful (*Educating the American Indian / Alaska Native Family*, 1989). The industrial schools have systematically attempted to eradicate non-western cultural traits and produce a student with a standardized set of skills and standardized world view. For Native students, formal education has too often meant relinquishing their culture and becoming "white" (O'Brien, 1990, p. 15).

The Native student is usually taught by non-Native teachers who serve as advocates for cultural assimilation. The cultural and technological supremacy of the scientific myth are continually reinforced in the classroom. From the non-Native teachers' perspective, assimilation remains the primary purpose of education (O'Brien, 1990, p. 18). In the words of Vine Deloria, Jr. (1990, Winter, p. 13):

> Education in the English-American context resembles indoctrination more than it does other forms of teaching because it insists on implanting a particular body of knowledge and a specific view of the world which often does not correspond to the life experiences that people have or might be expected to encounter.

Native students encounter cultural absolutism, forced assimilation, and low context secondary schools in the industrial education system. This system has not served the Native students well. However, there are few villains. The problems are systemic, organizational, structural, technological, and cultural. The industrial education system is also unsuccessful for many non-Native students for the simple reason that it is out of phase with reality. We are no longer living in the industrial age.

Paradigm — Information Age Education

In his landmark book, *The Structure of Scientific Revolutions*, Thomas Kuhn (1970) describes the phenomenon of paradigm shift. Paradigms are patterns that guide normal practices within a social system. Practitioners of the old paradigm regard new ideas with suspicion. The emergence of a new paradigm is always associated with crises (Kuhn, p. 69). Crises loosen the rules of the existing model and the system breaks down. Finally, the system shifts to a new paradigm — a new way of viewing reality and a new way of doing things.

A recent example of paradigm shift occurred throughout Eastern Europe in 1988. Information age technology was a driving force behind the overthrow of the Communist regimes. The deluge of electronic information from democratic societies overwhelmed the state information control apparatus throughout Eastern Europe. The governmental systems broke down and a new pattern is emerging.

The industrial paradigm of education is also entering a time of crises. There is a gap between the expectations of society and the outcomes of education. Numerous commissions and researchers have concluded that school performance is inadequate to meet the needs of modern society (Branson, 1987, p. 15). National task forces appointed to study the problem invariably urge educators to intensify existing educational practices — more homework, higher standards, more math, and more basic skills. Robert Branson suggests that school performance has reached the upper design limit (Branson, p. 15). Reforms directed toward increasing performance in the existing education system produce disappointing results. The existing model of schooling cannot be patched up to meet current and projected educational needs.

Fortunately, a new paradigm is on the horizon. We cannot predict the final form that it will take.

Nor can we accurately predict the time required for the shift. A paradigm shift can be a sudden transformation or it can be a gradual change. However, we can identify the technological and social forces moving education toward the new paradigm. We can describe several of the changes that are now occurring as the educational paradigm shifts from an industrial to a post-modern or information age model. Bramble, Mason and Berg have illustrated the paradigm shift as shown in Table 1.

For Natives, the industrial age educational paradigm has been a disaster. Industrial education

TABLE 1
Education in the Industrial Age and the Information Age

Industrial Age	Information Age
1. Promotes uniformity while stressing self-reliance.	1. Promotes individual variation while stressing collective responsibility.
2. Defines the core of education as knowledge of a set of basic mathematics and communication skills necessary for minimal economic survival in an industrial society	2. Stresses training of the mind in high level cognitiveskills and acquisition of knowledge. The term "to know" is redefined to include being able to locate facts, to interrelate data, and to evaluate.
3. Education is primarily for individual benefit. imperative.	3. Education is a national economic
4. Insular outlook.	4. Stresses a national economic imperative.
5 Promotes linear, sequential thinking. thinking.	5. Promotes non-linear, multi-dimensional
6. Textbook oriented.	6. Multimedia, experiential approaches to education.
7. Promotes rigid hierarchies among students and staff.	7. Hierarchical relationships are de-emphasized.
8. The teacher is the purveyor or knowledge. guide.	8. The teacher is a resource manage and
9. The teacher tends to deal with people in groups and categories	9. The teacher deals with groups and individuals.
10. Views the outcome of education as a set of knowledge. The school is conceived of in industrial terms as the production center for a product that can be measured with standardized tests.	10. Views the outcomes of education as a process. The results of education are indirectly observed and inferred
11. Education terminates at graduation.	11. Education is a lifelong experience.
12. Education creates economic and social mobility.	12. Education creates national wealth.

Source: Bramble, Mason & Berg, 1985, p. 300.

is inherently antagonistic to the goals of Native education. The industrial education system standardized human beings and denied the cultural rights of Native people. Schools do not meet the needs of Native students because they were never designed to serve this purpose. The good news is that the information age model is not inherently antagonistic to the goals of Native education.

Paradigm shifts create new ways of viewing old realities (Reaves, 1989, p. 17). The information age paradigm is a shift from a monocultural, reductionist world view of reality to multiple models of thinking and knowing. Industrial technologies were limited to supporting one view of reality and one way of knowing. The multiple models of communication available through information age technologies can support alternative views of reality and divergent paths to knowledge. This shift to multiple ways of knowing is central to education in the age of computers and television (McCracken, 1989, p. 20).

The technology of industrial education — the hardware, organizational structure, underlying assumptions and educational methods — has reached its upper limit of performance. How, then, can we improve Native education? Aircraft designers confronted a similar problem in the 1940s. Piston-engine aircraft had reached its theoretical upper limit of design performance. The designers used technological advances to design a new type of aircraft. A new paradigm emerged. The jet plane was born. The upper design limitations of speed, payload, and range were reset (Branson, 1987, p. 23).

In this paper, we are examining the jet engines of education, the advances in information processing technology which are bringing in the new paradigm.

New Tools for Education

Technology has changed the way that banks, travel agencies, hospitals, and industries do their work. Yet, schools remain relatively unaffected by the advent of computers and other information age technologies. The Office of Technology Assessment recently reported that the classrooms of today more closely resemble classrooms of 50 years ago than operating rooms or business offices resemble their ancestors despite a tremendous expansion of technology in schools during the 1980s (*Power on!*, pp. 1-4).

Several factors are responsible for the conservatism of the schools (Hathaway, 1989, Summer, p. 26):

1. The majority of teachers have little or no educational technology training according to the Office of Technology Assessment.
2. There is a built-in resistance to change the existing model of schooling.
3. New technologies tend to be used as improved versions of the previous technology. Radio was used as wireless telephone for over 20 years. Gradually, people realized that radio could serve as a mass communications media. Likewise, educators tend to use the new technologies in ways that reinforce the established methods of teaching. Computers made their debut in schools as electronic workbooks for drill and practice.
4. Useful technological tools have been slower to develop in the field of education than in other fields.

Revolutionary new tools are now becoming available in the field of education. These include local area networks, integrated learning systems, computer managed instruction, multimedia, and computer information systems. These tools are in their introductory phases. Schools are adapting them to the existing paradigm of instruction. They are not yet transforming schools. However, they have the potential to change the way curriculum is organized and presented. Collectively, they may be the jet engines of education.

Local Area Networks

"The days of the standalone computer are drawing to a close. Networks will dominate the educational technology scene into the 1990s" (Reinhold, 1989, March, Spec. Supp., p. 34).

A local area network is any computer system in which a single source computer drives more than one microcomputer or computer terminal. In a typical local area network in schools, cables connect 25 to 35 computers to a main computer called a file server. The file server "serves" the microcomputers by controlling software, messages, and the data flow between the microcomputers, the microcomputer and the server, and between the microcomputers and peripherals such as printers. Software is stored on the hard disk drive of the file server and uploaded to the individual microcomputers.

Local area networks are typically set up as computer labs in schools. The disadvantage of this arrangement is that the labs are a fixed schedule resource. Limited access restricts the impact of the computer lab to that of a supplemental activity. Some educators regard the computer lab environ-

ment as artificial, separate from the classroom context and a poor place for educational activities (Barnes, 1989, March, p. 15). The network may not become integrated into the curriculum as a tool and resource for students. In an attempt to overcome this limitation of networked computer labs, we are beginning to see computer networks distributed throughout the school building.

A distributed local area network consists of one or more file servers and a large number of interconnected computers located in classrooms or other key locations throughout the school. Distributed local area networks have the advantage of providing the students with more open access to computers. The computer resources are immediately available to the teacher and the student. For example, if the network is connected to a CD-ROM player, students can to access an interactive encyclopedia, reference books, graphic data, or other information resources from the classroom.

Local area computer networks offer many potential benefits to education:

1. More time on task for teachers and students — teachers no longer must keep stacks of floppy disks around the computer lab and waste time trying to load software on a room full of computers.
2. Enhanced access to software — each microcomputer can call up different programs from the server. Networks do away with the need to purchase multiple copies of software.
3. Learning management and report generation — when combined with learning management software, computer networks enhance the ability of educators to generate accurate information about student progress.
4. Expandability — networks are expandable as student population or user needs increase.
5. Increased access to shared resources — computer networks allow for open student access to information and tool software.
6. Electronic mail — networks can be connected to the outside world via modem and telephone line.

In addition to the above advantages, computer networks equipped with CD-ROM drives can provide students with immediate access to an encyclopedia, dictionary references, maps, images, important facts, and entire literary works. CD-ROM drives use laserdiscs similar to the compact audio discs which are replacing long playing records. A single CD can store up to 680 megabytes of information as printed text, images, sound, or graphics.

The success of computer networks in education is not a certainty. In a worst case scenario, computer networks may be used to intensify the principles of industrial schooling — automated lockstep instruction with trivial and impersonal learning objectives. The fate of language labs illustrates the misapplication of industrial school principles to educational technology.

During the 1960s, American public schools and colleges built over 6,000 language labs (Locke, 1965, May, p. 295). Language labs were the state-of-the-art educational technology at the time. The labs used sophisticated electronics to teach low level, vocabulary memorization skills. Students sat with their backs to the teacher and faced a machine. When researchers in the late 1960s and early 1970s found that there were no significant educational advantages to using this approach (Ackerman, 1966, August, p. 68), the labs fell into disuse. Very few language labs remain in use today.

Despite the difficulties associated with computer lab environments and fixed scheduling, the future of computers in education appears promising. The Congressional Office of Technology Assessment recently concluded that hundreds of studies reveal that elementary students who received brief, daily computerized lessons as a supplement to daily instruction showed gains equivalent to one to eight months over their peers who received traditional instruction only. (*Power On!*, p. 46)

Educators are only beginning to explore the potential of this new tool. Networks have the potential to empower Native students. The massive storage, retrieval, and branching capability of computer networks can provide immediate access to cultural information. Networks can promote student-to-student communication and direct access to resource people when linked to the outside world through telephone lines. Computer networks signal to us that education is no longer restricted to textbooks with one cultural frame of reference. However, the full potential of local area networks awaits the development of software which reflects a pluralistic and Native perspective.

Integrated Learning Systems

An integrated learning system (ILS) is a comprehensive educational software program designed to run on a local area network. The term, integrated learning system, refers to the software and the computer network. The majority of in-

tegrated learning systems marketed to schools teach reading, English, math, science, or writing for the elementary grades.

Typically, an ILS is located in a lab environment which must be shared by classes throughout the school. This limitation can be overcome by delivering the instructional software over a distributed local area network. Educators have been reluctant to rely on ILS training as the main instructional delivery system in core subject areas. Integrated learning systems are generally a supplement to traditional classroom instruction.

Kenneth Komoski notes that integrated learning systems tend to be closed-in systems in three ways. First, the systems that have been on the market for several years tend to use proprietary hardware made by the company. However, market pressures are encouraging ILS producers to write software for a variety of network hardware systems. Second, they are based on a proprietary set of software and, in some cases, print materials. This provision limits the ability of the end user to integrate other software or instructional materials into the instructional sequence. Third, most of the systems on the market today are aimed at basic skills for the at-risk learner (Komoski, 1987, p. 26). However, there are encouraging indications that this focus is expanding. Wasatch Education Systems, for example, includes word processing, a calculator, graphics tools, a spreadsheet, and a database as part of the instructional package to encourage students to use the computer as a tool.

Computer-Managed Instruction

Computer managed instruction (CMI) is the natural partner to integrated learning systems. Most integrated learning systems include a computerized management system for monitoring and reporting student progress. CMI may be used to manage a traditional, non-computerized instructional program. The general characteristics of CMI include:

1. a student database;
2. a bank of test items which includes a number of test items for each educational objective;
3. ability to evaluate student progress in the mastery of specific learning objectives;
4. a computerized testing capability or optical reader to score multiple choice handwritten tests; and
5. the ability to produce test data and produce reports about individual and group progress. (Tyre, 1988-89, December-January, p. 17)

Computer-managed instruction offers the advantages of minimizing the amount of time that educators spend grading tests, computing grade scores, and assessing progress toward learning objectives. CMI also has the potential to help educators identify learning problems and make necessary adjustments in the educational program. The use of computer-managed instruction does not guarantee increased educational achievement. Computer-managed instruction must be focused on valid learning objectives in order to be effective (Tyre, 1988-89, December-January, p. 25). A potential disadvantage of CMI is that it assumes a rigid, industrial model of learning through the mastery of separate, sequenced skills. This may not be effective in all subject areas for holistic learners.

Evaluation of Computer-Assisted Instructional Packages

The software industry has produced numerous computer-assisted instruction (CAI) software packages to meet the demand of educational systems. The CAI software packages vary greatly in purpose and quality. Mike Charleston, Lauren Villagomez and Lynette Shaffer (1989) developed a process of evaluating the appropriateness and effectiveness of CAI packages for the National Commission for Employment Policy. They developed and used the taxonomy presented below to organize the criteria used in an evaluation form for evaluating CAI software.

I. Types of CAI packages
   A. Purpose of the package
      1. Drill and Practice
      2. Supplemental Instruction
      3. Primary Instruction
      4. Simulation and Application
   B. Context Orientation of the Package
      1. Specific and general functional contexts of work
      2. Life skill context
      3. Child orientation
   C. Instructional Level(s) of the materials
      1. English-as-a-second language
      2. Basic literacy and adult basic education
      3. General Equivalency Diploma
      4. Advanced Skills

II. Quality Measures
   A. Curriculum design features
      1. Content
      2. Flexibility
      3. Feedback
      4. Learning styles

B. Software design features
   1. User interface with equipment
   2. Functional design components
      a. Menu systems
      b. Design components
      c. Interaction with user
      d. Management services
C. Implementation features
   1. Installation
   2. Speed of operation
   3. Performance options
   4. Maintenance and technical support

The evaluation of the appropriateness and effectiveness of commercial software for particular educational purposes is critical to successful implementation and use of CAI packages in Native education.

Multimedia

A lively drama unfolds on the screen. Native actors help teach Lakota language to students by engaging them in the role of a mediator in a civil dispute. Students pause the action, replay scenes, and touch any word on-screen to call up a visual dictionary with translations in either Lakota or English.

A team of students visits an elderly woman who lives along the creek bed. The students record the interview on videotape. Later, they combine the videotaped sound and images with historical photographs to create a multimedia presentation of life on the Pine Ridge Reservation during the 1930s.

These scenarios demonstrate realistic educational applications of multimedia technology.

Young people are no longer content to sit passively and learn from books. Textbooks present information in a controlled, linear sequence from the mainstream society's cultural perspective. Young people are aware of the power of computers and telecommunications as they grow up with Cable News Network and Music Television at home. Young people regard immediate access to information as a right. Awareness of the discrepancy between information access in the real world and the industrial school increases the dissatisfaction with public education.

Multimedia is a result of merging audio-visual electronic media and the computer. Computer-aided instruction has limited ability to model real-world objects due to low level graphics and synthetic sound. Multimedia combines life-like images and sound with the organizational and interactive capability of the computer. With the storage capability of CD-ROM, multimedia systems have the capacity to present students with video lessons using photographs, music, moving pictures, animation, text, and narration (Dillingham, 1990, May, p. 49).

Multimedia is not limited to presenting lessons to students. Multimedia provides a medium for students to become interactive learners. Students can create customized multimedia programs with specialized software such as Apple's Hypercard or IBM's Linkway. A student report may be an electronic presentation of text, sound, and visual information. Multimedia also has the potential to increase opportunities for team work and to develop inter-personal skills.

Multimedia stands out as an application that has the potential to play a major role in the future of Native education. Students with very little technical background can create customized multimedia programs that combine sound, images, and text. Multimedia can present lessons within a familiar cultural context. The fulfillment of this potential, however, awaits the development of culturally based instructional materials.

Large Scale Computer Information Systems

Educators are looking for computer systems that can serve entire schools, school districts, and colleges. Large scale computer information systems have the ability to track populations of students over time and evaluate large amounts of student data.

State-wide computer information systems are developing incrementally with the growth of computer networks. Several states now require school districts to submit financial and student data via direct computer link between the district's computer and the computer at the state level. The growth of computer information systems may help alleviate the lack of reliable data about Native education.

Bobby Wright, a member of the Chippewa-Cree tribe and researcher at Pennsylvania State University spoke of the need for a national database of information about Native education at the regional hearing in Billings, Montana. He testified, "We have typically undersampled American Indians causing our national data to be insufficient and unreliable. In most recent data released by the National Center for Educational Statistics (NCES) on the condition of education in 1990, information was reported by ethnic groups, but Natives were not included because of this lack of data" (High Plains Hearing, Wright, 1990).

These technologies have the potential to transform education. In actual practice, however, the

application of educational technology tends to be similar to the early experiences with radio as a wireless telephone. New technologies are often used as more efficient versions of the previous technology. Too frequently, sophisticated local area networks deliver low level drill and practice to eager minds. Integrated learning systems that support a narrow and ethnocentric view of education may merely be a more efficient means of achieving industrial educational goals. Realistic planning, achievable goals, and staff training are necessary for success with educational technology.

Scenario No. 1:

In the village of _____, the school has undergone a rapid change in recent years. The previous administrator initiated 21 new programs in the village school over the past five years.

As part of a technology initiative, the school district installed a state-of-the-art local area network in the school with an integrated learning system and learning management software. The computerized learning system began to dominate the curriculum. The integrated learning system became the core curriculum in this Alaska Native village. Faculty turnover ranged from 70-100 percent annually.

At the end of the fifth year, testing indicated that basic skills were the lowest of any public school population in the state (Leland Dishman, telephone interview, February 14, 1991).

Scenario No. 2:

Kwethluk Integrated Learning System

The village school of Kwethluk initiated a pilot project during the 1989-90 school year focused at improving basic reading and math skills for students in grades 2-8. The project made use of an integrated learning system from Jostens Learning Corporation and an IBM local area computer network with 20 computer stations. The network system included a CD-ROM player.

Principal Bob Medinger (Kwethluk Integrated Learning System Pilot Evaluation, 1989-90) reports that lessons were devised to have the students interact with the computer and focused on application skills. "Students read text, manipulate figures and shapes with a mouse, use calculators, have access to full color graphics and motion, hear digitized voiced instructions, and even talk to their computer with their individual headphone microphones. Students' voices are digitized and repeated on demand. This is a great feature for second language speakers."

Medinger reports that successful implementation of the system is dependent on staff involvement in the decision-making and training.

Results of the pilot program after the first year are as follows:

1. a mild increase in school attendance;
2. a 24 percent decrease in disciplinary referrals;
3. grade school reading scores improved substantially; and
4. math scores improved dramatically.

Scenario No. 1 illustrates the risk of regarding technology as a panacea. Lessons are not ennobled nor empowered simply because they are on a computer screen. Technology which does not meet the needs of Native students can damage education. In Scenario No. 2, the integrated learning system focused on limited objectives in reading and math. The staff carefully monitored the effects of the implementation. Staff commitment to the program was considered vital to success. The system directly addressed Native Education Goal #3 — Reading. While the Kwethluk application of an integrated learning system is too new to be considered exemplary, it is an example of a rational application of educational technology to an achievable educational goal.

Finally, it must be noted that educational technology is not currently revolutionizing schools. Few advances in the way lessons are organized and presented are incorporated into software of the new instructional systems (as cited by Borton, 1988, Summer, p. 95). Real advancement in the use of these new tools awaits the development of new software and methods of instruction. However, we believe these new educational tools have the potential to empower Native students when employed to serve the goals of Native education. Computer systems, with their ability to access and present large amounts of information, have the potential to overcome the restrictions of monocultural, industrial education.

Distance Education and Educational Networking

A natural extension of local networking and large scale computer systems is the use of geographically dispersed information networks (phone, mail, and TV) to expand learning resources and to personalize learning. Students using these systems engage in distance education. Distance education is education that occurs when students are in one place and teachers, peer learners, and/or resources are in another.

Distance education is best explained by example. Parts of the following example are borrowed from the report on distance learning prepared for the Office of the U.S. Congress, Office of Technology Assessment (OTA) (Ohler, 1989). Although this example is fictitious, variations of the system described below exist at a number of places in the United States.

> Imagine: Instead of sitting in a classroom to learn American history, your teenage daughter goes to a special viewing room at school or at a community center with a group of her peers, or perhaps even stays at home by herself, and settles in front of the television. With a glass of juice, notebook, telephone, and computer close by, she punches the remote control. On comes Mr. Johnson, standing at the blackboard in Studio B somewhere on the East coast of the United States explaining the origins of the Civil War. Confused by something she has just heard, your daughter places a telephone call. Seeing the red light flashing on his portacom, Mr. Johnson stops. "Yes?" "Mr. Johnson, this is Becky in San Francisco. I don't get it when you say the Civil War had more to do with economics than slavery. Can you explain that more?"
>
> "How many other people are having that problem?" asks Mr. Johnson. He checks a bank of monitors and discovers that 78 of his 135 students in 11 states have registered an affirmative answer through their computers. "Hmmm. I see there are a number of you. It looks like I need to go over that area more thoroughly. First let me send you a map of the United States that shows the kinds of economic activities that were going on around the time of the war. This will be very useful in my explanation." The promised map immediately begins to appear on Becky's printer, as well as those of her online classmates. "And let's switch gears in terms of tonight's assignment. Each of you should send your tutor a half page about this concept, and they will post the best from each learning group to the electronic bulletin board. Log on sometime Monday with your computer and read what the others have said. You have much to learn from each other."

The Social Context of Distance Education

Distance education may appear to serve only the geographically disadvantaged. Public education originally turned to distance delivery as the most cost-effective means of extending equal education to those who did not live within busing distance of a school. Distance education is suitable for many types of students sharing a similar trait: they all feel somehow *distant* or excluded from the educational system. For some, the distance is physical. For others, it is cultural or psychological.

Distance learners do not necessarily live in remote areas. We need a redefinition of terms. We are talking about dispersed or *decentralized* learners who are recombined or *networked* to form new learning communities that are less dependent upon common space and old formulae for the maintenance of public education. *Decentralization* often individualizes, while *networking* reconstructs, often in cooperative situations.

Those who turn to distance education are in search of options. Ten years ago, the options were limited. Today, they are numerous and growing rapidly. Those willing to seek will find that media can effectively transport experts from around the country and the world into their homes and schools.

Distance education is the first significant experiment with the medium of the learning environment in centuries. It counters the trend of centralized, norm-minded, teacher-oriented pedagogy that dominates the industrial age learning model.

Distance education can be developed by and for specialized audiences. To understand the broad appeal that distance education has, consider it from Becky's point of view. Why has she turned to using a non-traditional method of learning? In the report to the Office of Technology Assessment, Ohler identified 19 possible reasons for using distance education. However, reasons 7 and 18 are particularly appropriate for the Native community:

> 7) **To avoid having to abandon a life-style or culture**. Perhaps Becky lives an alternative life-style, on a farm, on the road, or even on a boat ... The refusal to abandon culture is perhaps one of the most poignant rationales for the use of distance education by the Native population. Perhaps Becky is a Native American and chooses to live in her community in order to retain her cultural context as the framework of her learning while importing western education on her own terms. This approach is very imperfect in its design concept, ensuring the displacement of some indigenous life-style practice. Also, the unusual nature of learning by audio convener or TV can be intimidating. But, this approach allows students to straddle two cultures. The proposed Native Open Learning Network in British Columbia offers an instructive example in this regard. It proposes to tie together seven Native communities or in-

stitutions with Native concerns with an electronic educational delivery system, allowing them to teach one another and avoid non-Native, non-multicultural mainstream education which they feel has done a poor job of meeting their educational needs.

18) **To associate with a particular segment of society or, conversely, to become diffused within a heterogeneous population** ... Decentralized, on-line education can enable students to associate academically, socially, or politically with a particular homogeneous segment of the population. That is, a geographically dispersed segment of society, such as the disabled or the elderly to name just a couple, can learn or interact "together" despite their lack of co-location. This allows Becky to change or experiment with her sense of identification by joining groups with which she might not normally associate herself. Efforts are underway already, linking the news of indigenous populations.

Conversely, those who do not wish to identify with a particular segment of society to which they may belong can often become diffused in the mainstream of heterogeneous, on-line community because of the anonymity it can offer. It can offer Becky the escape she may need from prejudice or social stigma that might be associated with her.

These two points highlight the dilemma faced by a Native educational community: assimilating to some degree into mainstream culture versus maintaining the integrity and uniqueness of the Native society. In reality, some combination is probably desirable, and this is precisely the opportunity afforded by distance education and educational networking. Students are allowed to hold a citizenship in two educational systems, one traditional and one mainstream.

The Technologies of Distance Education

Distance learning relationships can be maintained using different technologies. The more common ones are described below.

1. **Correspondence Education**. This involves the exchange of printed, and recently taped, material between teacher and student via post. This is an inexpensive, time-honored approach to distance education. Correspondence methods are nearly always used to some extent in distance education programs.

Many distance educators draw a sharp distinction between correspondence and modern distance education. Interactivity is the important ingredient between the two. Not until technology allowed interaction among teachers and remotely located students did the education community feel distance education was credible enough to use within a school setting.

2. **Computer Networking**. Often called *going on-line*, networking connects computers via the phone system in inexpensive and powerful ways to send messages (called electronic mail), to access data, or to join conferences. Networking allows people from many parts of the world to share information, to work on joint projects, and to act as a unified though geographically dispersed body. In the example above, when Becky's teacher asked her to "Log on sometime Monday with your computer and read what the others have said," he asked her to join a computer network that connects her with classmates who share ideas and information. A unique strength of computer networking is it does not happen in *real time*. Network members leave and pick messages when it is convenient, allowing maximum schedule flexibility and reflection time between responses.

Hundreds, perhaps thousands, of educational networks, resources, and on-line projects are in existence, most of which were not in existence ten years ago.

3. **Radio**. This underused technology has fallen into disfavor in an era of highly visual media. However, it is much cheaper to produce than TV, and when supplemented by print-based material can be an effective teaching tool.
4. **Audio-Conferencing**. This allows geographically dispersed people to place a phone call to a "bridge" that connects them together. In Alaska, audio-conferencing has become a way of life in many educational districts committed to delivering education to remote regions.
5. **One-way television**. One-way TV contains no interactive portion of the information presentation. The TV technologies below are used in this way:
   a. **Broadcast TV** — This is "regular" TV, the audience receives the TV signal without special antennas or connections. Local TV stations (usually affiliated with one of the large networks such as CBS, NBC, ABC) provide service on a community basis.

b. **Public Broadcasting Service (PBS) TV** — This is a form of broadcast TV that is far less commercial in nature. PBS can be a rich source of educational programming.

c. **Community Access TV (CATV)** — CATV, often referred to as "cable TV", is only available to those hooked directly by cable to the local programming service. Changes in FCC law no longer require cable companies to provide public access to facilities and channels; many stations still do. Several education programs have been launched using CATV services.

d. **Direct Broadcast** — Owners of satellite dish receive TV signals directly from satellite, often bypassing cable operators.

e. **Instructional Television Fixed Services (ITFS)** — The FCC has reserved part of the TV broadcasting frequencies for communities to broadcast to all parts of a school district.

6. **Talk Back TV**. This is the common name for the system using one-way video (TV teacher) and a two-way audio (phone link), as in Becky's case. The printer and computer network in Becky's system are not standard, but they are becoming increasingly desirable and are appearing more often. About a half dozen talk back networks are in existence, covering most of the United States and offering courses in most academic areas.

7. **Two-way Video**. This allows teachers and students continual video contact. It is quite expensive, though a special form of it called "compressed video" offers substantial savings.

8. **Audio Graphics**. This combines audio conferencing with an electronic chalkboard. Students and teachers draw on a table or screen that transmits the image to all others on the network. It is an inexpensive way to transmit graphic images and can be used effectively to deliver quality education in subject areas such as science and math.

9. **Phone Line Technologies**. Common facsimile machines, simple phone and phone recording technology, slow scan (allowing for the very slow sending of pictures), and other technologies have a potential role in distance education. These technologies require a regular phone line for transmission of information.

10. **At-Home and Stand-Alone Technologies**. Computer software, television, optical disks, and multimedia technologies that function as individualized learning stations offer a quasi in-house-yet-at-a-distance learning alternative. However, as the quality of these machines increases and their prices decrease, it is easy to envision them being used in schools and homes as primary staples of distance-delivered education, serving much the same capacity as books. In such cases, most of the work is carried out between the student and the machine, with human guidance via telephone, computer networking, or a learning assistant. Videocassette recorders (VCR) are particularly important in a distance education program. At one point, 80 percent of Alaskan distance education students had VHS VCRs.

Although this list is not complete, it highlights the common distance delivery systems used today. The continual evolution of these technologies, combined with the reinterpretation of older technologies promises to maintain a fresh supply of learning options.

Current Native Programs

Two problems confound the identification of Native distance education and networking programs. First, modern distance education data is hard to find. The educational community has not considered distance education as a learning option until the development of interactive technologies during the past decade. Thus, much of distance education is new and undocumented.

Second, there are very few completely "Native" distance education programs or networks. The rural and distance education programs that serve cross-cultural communities rarely keep data on the ethnicity of their clientele.

1. **Native American Teleteaching Network (NATN)**. This successful pilot project uses audiographic technology to connect five of the American Indian colleges in the 21 college American Higher Education Consortium and is seeking to expand its connections.

2. **NativeNet**. This is an international computer network that deals with issues and current events affecting indigenous populations.

3. **The Russell Bulletin Board (Russell BB).** Also called the Native Art Network, this project is an innovative education computer network serving rural Montana. The Russell BB project consists of Native artists using computer graphic software to distribute their artwork via computer to anyone connected to the computer networks. Its members hope to attract Native computer artists from around the world and to serve as an international clearing house for the work.
4. **Educational Native American Network (ENAN).** This is a project of the Bureau of Indian Affairs, the University of New Mexico, and Tandy Corporation. ENAN was targeted for Native American Schools. With approval, others may access this network for discussions and information, to converse with Native children and to take courses offered by the University of New Mexico.
5. **Oglala Lakota College.** The 11 centers that comprise this college in South Dakota make extensive use of FAX, centralized resource data bases, and a rotating library.
6. **Ktunaxa/Kinbasket Independent School System (KKISS) Audiographic.** This is like NATN except that it serves high school students in Eastern British Columbia. It is funded by the Native communities.
7. **Iowa Indian Defense Network.** This is a computer bulletin board system run by the Iowa Chapter of the American Indian Law School Association and the University of Iowa College of Law. An "IIDN is a computer bulletin board dedicated to the exchange of information, views, assistance, and materials relevant to the defense of American Indian Rights, to Indian Policy, tribal government, tribal news and other Indian Affairs questions" (E-mail message, 1991, February 16).
8. **Northern Arizona University (NAU).** NAU has an active Native outreach program that uses computer networking and an unusual form of distance delivery: cars. Teachers from the university drive to Native communities to assist with learning. This approach still meets both requirements of distance education; — students remain in their culture and school comes to them.
9. **Open Learning Institute (OLI) of British Columbia.** OLI uses many components, including a TV channel (Knowledge Network) and a correspondence study unit. One project within OLI uses on-site tutors to serve remote communities with high Native populations. On-site tutors facilitate and support students. Toll-free phone support is a available when on-site tutors cannot be hired.
10. **Audio-conferencing and other delivery systems in Alaska.** Alaska uses audio-conferencing extensively to reach rural students. In *Distance Education in Rural Alaska*, Barry Sponder (1990) reports that up to 40 percent of western Alaskan students are Native. Many experience some form on non-traditional educational delivery. An audio-graphic pilot project lead by Greg Moore at Chukchi Community College serves Native communities. In addition, video services and correspondence serve Alaska's "bush" communities.
11. **Summer Beaver Distance Education.** Summer Beaver, Ontario uses radio, FAX, audio-conferencing, computer networking and correspondence to offer high school courses to remote Native student populations.

Technology Training for Educators

"The use of technology requires qualitative new skills because it shakes up what teachers are used to doing in the classroom" (Revenaugh, 1989, March, p. 20).

The majority of teachers have little or no computer education or training according to the Congressional Office of Technology Assessment (*Power On!*, Summary, p. 16). Technology has outpaced the ability of many universities and school districts to provide adequate preservice and inservice training. Without adequate training for teachers and administrators, technological innovation in education will not succeed and may lead to lower educational achievement. In this section, we examine the training methods that support the introduction of successful technologies into education.

Technology Redefines the Role of Teachers

The role of the teacher is changing. Educators are examining the cherished practices of the self-

contained classroom. Traditional classroom practices promote teacher talk, individual competition, and textbooks. The introduction of computers, telecommunications, and video technology in the classroom destabilizes this paradigm.

Effective technology training assists teachers to expand their roles as managers and facilitators of learning (*Power On!*, Summary, p. 14). Facilitators of learning are more accepting of diverse perspectives and methods of instruction. When teachers become managers and facilitators of learning, students can be engaged in more individualized and customized education (Hathaway, 1989, Summer, p. 30). Facilitators of learning are more open to teaching with multiple cultural perspectives than teachers who perceive themselves as the primary source of knowledge for their students.

Teachers Select Useful Innovations

The educational historian Larry Cuban observes that the school and classroom organizational framework establish the boundaries in which the teacher's beliefs and work practices develop. Changes that teachers have embraced, according to Cuban, are those that have solved problems that teachers have identified. Teachers adopt technological innovations that enhance the authority and stature of the profession. Cuban notes that over time, it is teachers who ultimately decide what innovations are accepted or rejected in education. Only a small fraction of long-term, classroom changes have resulted from the designs of policy makers (Cuban, 1986).

Educational technology is rarely adopted successfully through a top-down decision-making process. Successful implementation of educational technology involves bottom-up adoption or the development of a broad-based, community-teacher-administration consensus. This challenging situation requires new strategies for training both teachers and administrators. The following are techniques and ideas that we have used ourselves, have found in the literature, or have discussed with experts and practitioners who work in the field of educational technology training.

Introduce Educational Solutions — Not Technological Solutions

Trainers can introduce teachers to technology by linking technology to existing needs and priorities of the classroom. One successful training strategy is to present the computer as a teacher's aid for accomplishing daily tasks such as recording grades, writing letters to parents, and maintaining classroom records. Many teachers also use a classroom computer as an audio-visual demonstration device (Nasman, 1987, October 6, p. 3). Teachers who began using computers for daily classroom tasks generally develop new skills and new ways of teaching.

Technology is a means to an educational goal, not an end in itself. For example, the goal of providing students with 60 minutes of computer time each week is a technology goal, not an educational goal. A legitimate and desired educational goal would be to improve writing proficiency. Even when the educational goal is expressed in narrow terms such as scores on an achievement test, we believe that such uses of technology are a first step in the adaptation of these new tools to education. The process of shifting from the industrial model to an information age model begins with using the technology to accomplish familiar tasks. The accumulated effects of successful experience with computers and other advanced technologies in schools are transformational.

Effective Technology Training Techniques

Revenaugh has identified a set of effective practices for a staff computer inservice training program.

1. Make sure the objectives are clear and relevant.
2. Maintain an appropriate balance between lecture and hand-on experience.
3. Have lesson plans, guides and handouts available.
4. Relate instruction to common classroom (or administrative — author's note) practices.
5. Allow plenty of opportunities for peer interaction.
6. Consider whether the program will meet the needs of advanced computer users as well as those of beginners.
7. Follow-up the initial training with additional training and support (Revenaugh, 1989, March, p. 22).

Administrator Training

Administrators prefers to adopt technoiogical innovations that meet perceived needs and solve problems. Computers can be introduced as a budgetary analysis tool using spreadsheet software. The ability to perform if-then-what budget analysis and projections is a valuable aid to

administrators (Nasman, 1987, October 6, p. 4). Administrative staff also find the communications capabilities of microcomputers valuable, especially word processing and telecommunications.

Technology is only one training area among numerous others that have been identified as important to administrators in schools with Native students. Pavlik notes that the majority of school administrators lacks the necessary characteristics and training to cope with the unique challenges of Native education (Pavlik, 1988, May, p. 17).

Barnhardt found that most school administrators are trained to be managers of bureaucracies. Training in budget, law, finance, and personnel management are designed to enable them to function in a uniform environment characterized by likeness and control (as cited by Pavlik, 1988, May, p. 18). Administrators are indoctrinated in the culture of the industrial system of schooling.

Barnhardt calls for a new style of administration for schools serving Native populations. Barnhardt believes that the Native school administrator should:

1. Generate, rather than produce variables.
2. Decentralize control.
3. Maintain informal, rather than formal relations.
4. Maintain a loose structure.
5. Be difference-oriented.
6. Emphasize horizontal relations.
7. Be non-directive.
8. See that information flows in, not only out.
9. Assume a facilitating, rather than a managing role.
10. Establish implicit rather than explicit rules.
11. Maintain open communication channels.
12. Be process/direction, rather than content/product, oriented.
13. Have a diverging rather than converging focus.
14. Be receptive to change
15. Maintain an evolutionary rather than static structure and function.
16. Be downward responsive.
17. Emphasize personal relationships (as cited by Pavlik, 1988, May, pp. 18-19).

Barnhardt's model is consistent with the information age model of schooling. It rejects the rigidity of the industrial model and stresses a flexible and adaptive style of administration.

We believe that universities should prepare administrators for the leadership roles identified by Barnhardt. Administrators need to be trained to use computers and related technologies to support administrative functions. Administrative training should not be an indoctrination in the industrial model of schooling. Stress should be placed on training administrators to empower students, parents, community, and staff. Most important, we believe that administrators must be aware of the transformational power of technology and the potential for using technology to support a culture based curriculum for Native students.

Connie Fulmer and Mike Charleston (1990) studied the integration of microcomputers into educational administration courses. They found that such courses should progress from highly structured computer assignments for students with low levels of computing skills to more ambitious and ambiguous assignments that develop higher level thinking skills. For success, students need a threshold level of functional proficiency with computers prior to integration of technical skills with the theoretical content of the courses. Personal access to computers rather than public access via computer labs greatly enhance learning and creativity. Educational administration students working and learning in cooperative problem-solving work groups with computers helps prepare future administrators for modern organizational structures and administrative experiences in schools.

Technology Education

Computer Competence ... the Fourth Basic Skill

In 1983, A Nation at Risk identified computer competence as a fourth basic skill (Nation at Risk, 1983, April, p. 3). Computer literacy quickly became a new educational buzzword. State and local education agencies mandated computer literacy training. Regional and local definitions of computer literacy proliferated. For some educators, computer literacy meant the ability to program a computer. Others felt that computer literacy should include the ability to use tool software such as word processing, data bases, and graphic packages. Yet to others, computer literacy meant the ability to turn on the computer and run simple software.

Despite the initial rush to use computers in schools during the early 1980s, the first national assessment of computer competence conducted by

Educational Testing Service (ETC) in 1988 found that students seldom used computers in subjects such as reading, science, or mathematics (Martinez & Mead, 1988, April, p. 3). ETS also reported racial/ethnic differences in technology competence that favor white students (Martinez & Mead, p. 6).

Computer Literacy ... A New Perspective

In 1985, the Alaska Department of Education issued model curriculum guides for elementary and secondary computer education. The guides suggested that schools teach computer skills at specific grade levels and implied that computer education was a new and separate educational subject (Computer Education, Alaska Elementary and Secondary Curriculum Guides, First Edition, 1985, Alaska Department of Education).

In 1990, the Alaska Department of Education published the second edition titled "Computers and Related Technologies." The guide states that students should use computers and related technologies as tools as part of the school curriculum. The Model Computer Curriculum Guide is now followed by a publication titled "Design Strategy for Implementation of Computers and Related Technologies in the Curriculum" (Alaska Department of Education, 1990, April). This shift in philosophy concerning computer training is the result of collective experience with educational computing over the past decade.

The Alaska Department of Education defines computer literacy as "... the knowledge, skills, and values needed for students to use computers and related technologies efficiently and appropriately as tools to solve problems" (Alaska Department of Education, 1990, April, p. 4). The most effective method of training students to be technologically literate is to incorporate computers and related technologies into the total instructional program of the school.

Technology as a Tool

Computers and other educational technologies are effective when used actively by students. Computer applications such as word processing, spreadsheets, graphics packages, and telecommunications increase the ability of students to express themselves and to solve complex problems. By actively using computers and related technologies, students can extend their learning beyond the boundaries set by printed instructional media. The role of the student changes from that of a passive recipient of information to an active participant.

Examples of Technology in Native Education

The following are technology applications that address one or more of the goals of Native education identified by the Task Force.

Cooperative Learning With Computers

The Hupa, Yurok, Karuk, and Tolowa tribes in California and Humbolt State University have developed a cooperative learning methodology for teaching writing and reading and computer skills. The tribes produce their own bilingual materials using a phonetic alphabet installed on MacIntosh computers. Ruth Bennett (1987) of Humbolt State reports that the teamwork and peer coaching involved with the cooperative learning closely parallels the traditional teaching style found in the homes of the children (Bennett, p. 4).

The project developed bilingual dictionaries to assist in the learning of sentence-building skills, to increase knowledge about the natural world, and to integrate computers and cooperative learning (Bennett, 1987, p. 3). The project involved several steps:

1. creation of a font for each of the four languages;
2. installation of the fonts into MacWrite and MacPaint; and then
3. creation of a dictionary.

> Groups of elementary school children, grades three through eight, were divided into teams of 2-3, and each team was told that their task for the day was to create one page in a dictionary. The dictionary was to contain names for plants or animals familiar to them. Each of the children chose one dictionary entry, and the child was told to 'tell what they knew about the animal or plant.' The child then composed sentences that were transcribed in Hupa or Yurok, using the Uniron fonts, and translated into English with the help of the bilingual resources teacher. (Bennett, 1987, p. 4)

Project participants reported that modeling is a major learning role for the students. Younger students were strongly influenced by the work done by the older students. This method of learning is consistent with traditional patterns and represents a blending of an information age technology with a traditional cultural learning style.

Cooperative learning allowed older students to serve as role models and the teacher to function as a resource. "The advantage of cooperative learning is that it involves teacher, older student, and

younger student in a triad of participation that utilizes the teacher's knowledge, but emphasizes the older students' expertise as a teacher" (Bennett, 1987, p. 7).

The Hualapai Cultural and Environmental Curriculum

Peach Springs is a small town in Arizona and home to most of the 1,500 members of the Hualapai tribe. The school has 236 students in kindergarten through eighth grade and a classified staff of 36. The economy of the area consists of cattle ranching, forestry, wildlife, recreation, and federally funded programs. Children attend ceremonies and special gatherings presided over by Elders and adults throughout the year. Tribal members are expected to learn to speak Hualapai at these special gatherings. The oral tradition is strong. Sharing of wealth among the members of the community is encouraged.

By the time the children reach school, they have participated in important cultural events and have a strong sense of their place in the world. Children as young as eight years old care for younger siblings and assist with chores at home. Parents encourage children to be independent and to make decisions for themselves.

The school program at Peach Springs is an extension of the culture of the community. The program philosophy states:

> The Hualapai Bilingual Academic Excellence Program promotes a positive order of beliefs: that man is a social being who interacts with his world in a significant role in harmony with nature, that the nature of man is active, and knowledge as the dynamic process of becoming and the purpose of life is to develop human uniqueness. An individual's culture and language shapes his perceptions and values. Each individual is important to the community, and everyone has a role of significance within the community. (The Hualapai Cultural and Environmental Curriculum Model and Exemplary Features, 1988, HBAEP Peach Springs School District No. 8, Peach Springs, AZ)

Peach Springs school has integrated technology into the education program. Project Technology and Tradition (Project TNT) is described by the school district as a process oriented curriculum development model that identifies the needs and expectations of a community for its children and makes extensive use of community resources including Elders, parents, community members, and tribal government (Project Tradition and Technology, 1988).

The goals of the technology program are to provide students with access to a variety of computer and audio-visual tools and promote proficiency in their use, increase student communicative competence in Hualapai and English through technology, and to develop awareness of the future impact of technology.

Students use computer and video technology to support bilingual education throughout the curriculum. Using networked computers, students have maximum access to computers for computer-assisted instruction, word processing, compatible speller, and data bases. Staff members administer individualized instruction with computer-managed instruction. Students also learn video production and produce their own video programs to develop their communication skills. The school district reports that this technology model is one of twelve programs recognized by the Office of Bilingual Education and Minority Language Affairs, U.S. Department of Education (Project Tradition and Technology, 1988).

Teaching Writing with Alaska Writing Machine

In 1982, the Yukon Koyukuk School District in Alaska received a Title VII grant to use microcomputers for improving English language skills among 300 Koyukuk Athabaskan fourth through twelfth grade students in ten villages. Over the past eight years, the school district has developed a comprehensive set of writing software called collectively, the Alaska Writing Machine.

The school district developed the software after extensive investigation into the writing skills of the students in the Yukon Koyukuk region. Care was taken to ensure that the software followed the research on effective writing instruction (Wresch, 1989, p. 39).

The courseware development process followed six steps:

1. Conduct a contrast analysis of local English.
2. Establish the instructional priorities.
3. Identify appropriate commercial software.
4. Select objectives for software development.
5. Develop the software.
6. Implement the software through staff training and distribution (McCurry & Kleinfeld, 1986, May, p. 34).

The school district developed 13 different kits offering hundreds of hours of instruction. At the present time, more than half the schools throughout the state of Alaska are using the

materials (McCurry & Kleinfeld, p. 37). According to the project director, Dr. Miki McCurry, "Writing and reading must be personally relevant to the child ... Cultural relevance is one of the validated techniques of effective instruction" (McCurry, telephone interview, 1991, January 7).

Since the project began in 1982, student reading and language use scores in the Yukon Koyukuk School District have climbed from below the 10th percentile to just below the 40th percentile (McCurry & Kleinfeld, p. 37).

The Yugtarvik Museum Project

Teachers and students at the University of Alaska-Fairbanks, Kuskokwim Campus have developed a multimedia, MacIntosh-videodisc program that uses exhibits from the Yugtarvik Yup'ik Eskimo Museum in Bethel, Alaska. The MacIntosh computer controls a locally developed videodisc which narrates in the Yup'ik language and teaches about many aspects of traditional Eskimo culture. The program is used for teacher preparation and as part of the distance delivery of courses in rural areas of the region.

The project is helping to preserve Yup'ik culture by recording information about Alaska Native artifacts found throughout Alaska, according to the project directors, Barry Sponder and Dennis Schall. "These treasures will now be accessible to future generations of Native and non-Native students through the use of the computer-videodisc technology" (Sponder & Schall, 1990, April, p. 6).

Eskimo students programmed the computer to control the videodisc with Apple's Hypercard program. "Teaching students to develop their own multimedia applications has been the real benefit of the Yugtarvik Museum Project" (Sponder & Schall, 1990, April, p. 44). The success of the museum project has encouraged additional multimedia development. The United States Department of Education recently awarded a grant to the University to develop a videodisc using the Yup'ik Eskimo context to teach biology to nursing students.

Problem Solving in Gamble, Alaska

Gamble, Alaska, is a small Siberian-Yup'ik Eskimo village. The high school consists of five classrooms, a gymnasium, and 36 students. Classes are conducted in English, but outside the school, Yup'ik is spoken. Knowledge of the outside world is minimal.

In 1984, two teams of students from the village stunned the world of academic competition by winning at the International Problem Solving Competition. The subject of the competition was generic engineering. Both teams from Gamble won first place in their respective age divisions, the first double win in the history of the International Problem Solving program.

George Guthridge, Gamble teacher and team coach, realized that the standard teaching techniques did not work with his students. Guthridge observed the way parents and Elders taught the children. Youngsters observed silently, absorbing information and memorizing details. Success must come with the first try. There is no room for error for a hunter out on the ice at 20 degrees below zero. Guthridge saw that his students were astute observers and that they had excellent memories.

Guthridge applied Eskimo training to the school setting. His students read and memorized possible problems and solutions for the Future Problem Solving competition. The work proceeded at a slow pace; memorization first, then familiarization, later conceptualization, and finally, creativity. The students learned to apply the skills of a subsistence hunting culture to modern scientific problems.

The results were astonishing ... the double win at Future Problem Solving in 1984, six state awards and five international short story awards ... this in a village infamous for student absenteeism and indifference to education (Guthridge, 1986, pp. 66-74).

The Gamble experience demonstrates that Native cultures have evolved sophisticated teaching "technology." George Guthridge incorporated the teaching methods of the Yup'ik culture into his classroom with astounding results. When asked by reporters, "How did they do it?" Guthridge felt the question improper. Rather, they should ask, "Why shouldn't they win?" (Guthridge, p. 69).

Conclusions

People worldwide are using computers and related technologies to maintain language and culture. Natives have been slow to benefit from the power of technology (Sponder & Schall, 1990, April, p. 6). However, we see evidence that this is beginning to change.

As part of our research, we contacted people from every major region of the United States. As we traveled via electronic mail, phone or mail, we came across indications that Native educators, organizations, and tribes are beginning to turn to technology to help meet challenges and solve problems.

We identified six basic reasons why Native groups are turning to technology-assisted solutions to address educational problems:

1. To gain skills to compete in mainstream culture.
2. To maintain traditional knowledge and/or blend it with a contemporary understanding of the world to create new knowledge.
3. To discover and strengthen Native identity within the tribe and within the broader world of Native culture.
4. To organize as a Native community, sometimes across tribal lines and over great geographical distance in order to:
   a. provide more culturally relevant and informed education,
   b. share news and information relevant to Native concerns, and
   c. to organize politically.
5. To share Native culture as an educational or artistic product.
6. To teach non-Natives about Native culture.

It comes as no surprise that the use of technology is increasing among Native educators and political leaders. Natives are a technological people. The technology of the Eskimo kayak is unsurpassed. Corn and potatoes, which are products of generations of selective planting by Native farmers, feed the world. Natives have also adopted technology as needed. The iron pot and trade goods contributed to the flowering of the Great Plains cultures during the 18th and 19th centuries.

We believe Native education is at a turning point. The American education system, based on industrial technology, has inadequately served Native students. Computers and related technologies are creating a window of opportunity for Natives to seize the initiative. There is no one best way to use educational technology to improve the quality of Native education. The power of the technology rests in its varied capabilities to expand the learning experiences of students (*Power On*!, p. 9).

Technology can increase the depth and breadth of the educational experience and make Native culture accessible to students within a redefined school environment. If Native people seize the technological initiative, Native education can experience a new age of excellence.

The transformation that we perceive is not inevitable. In the absence of organized and concerted efforts to direct educational change, information age technologies may be used to promote the outdated assumptions, curricula, and methodologies of industrial schooling. Native direction of the development and implementation of educational technology is essential.

Underlying the transformation of education is a redefinition of freedom to include the cultural rights of Native people. No individual, agency, education system or government has the authority to deny Native people the right to live according to their own cultural direction. Technology can be a powerful tool to help ensure this freedom.

Recommendations

A window of opportunity exists. Natives must seize the technological initiative to advance the cause of cultural rights and Native education. We recommend the following to achieve these goals:

1. Native parents should form parent advocacy groups to advocate for access to cultural resources for Native students. School systems serving Native students should be encouraged to make use of educational technology, especially multimedia, to provide access to Native cultural resources.
2. School systems serving Native students should integrate computer training within the context of the total school curriculum. Students should actively use computers and related technologies as tools for exploring and creating.
3. Natives should take the lead in teaching non-Natives about Native culture. A potential area of development lies in Native-created courseware for non-Native and Native communities via distance delivery means. Native educators should influence publishers to include the Native perspective in textbooks. At the University of Calgary, there is an effort to rewrite science books to include a more holistic perspective of indigenous cultures. Television, computer software, laserdisc, and distance delivery are means of sharing the Native cultural perspective with non-Natives.
4. Native organizations, school systems serving Native students, state departments of education, and the federal government should make a concerted effort to develop culturally relevant software for Native students. There is a lack of culture-based instructional material available for computers and multimedia instructional systems. Consideration should be given to developing materials for specific Native tribes and nations.

5. Natives should make increased use of computer networking as a vehicle for organizing as a social and political voice and share information among the geographically dispersed Native community. Computer networking can be a powerful tool for organizing to influence the politics of education.
6. Native organizations, in partnership with the federal government, should establish a National Native Education Institute. The Institute should include research, materials development, and training staff to provide the following services to educational institutions that serve Native students:
   a. Conduct research and identify effective educational strategies for Native students. Particular attention would be paid to educational strategies that involve the use of computers and related technologies.
   b. Develop instructional materials — print, computer software, and video format.
   c. Provide training and training materials to educational institutions that serve Native students.
   d. Disseminate information to focus national attention on the educational needs of Native students.
   e. Establish a national Native Education Computer Network to serve as a communication link and information resource for educators and students.

The creation of a national institute requires a national commitment at a policy-making level. This level of commitment is necessary to achieve results.

Korea provides us with an excellent model for the national institute approach. The Korean War destroyed the education system. From this shattered base, Korean students have become the world leaders in mathematics education based on international math assessments. The Koreans began by clearly documenting the problem. The Korean government then made a strong national commitment to make the necessary changes. They created an infrastructure in the form of the Korean Educational Development Institute to provide training, research, materials design, and evaluation services to the school system (Branson, 1987, p. 22). The commitment and multi-year effort succeeded in institutionalizing the successful practices in the nation's schools. What is stunning about this success story is that this achievement was organized with the help of American educational consultants and paid for with American money! This approach can work for Native people.

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